

# **Model Based Systems Engineering**

## **Best Practice From Space**

Philipp M. Fischer

Software for Space Systems and Interactive Visualization

Lilienthalplatz 7 / 38108 Braunschweig

Software Systems for Digitalization

Mälzerstraße 3 / 07745 Jena



Wissen für Morgen



# We Want to Do Model Based Systems Engineering – Now what...

## Model based Systems Engineering is More Than Installing a Tool

Several times a year on the telephone:

*„Hi Phil! We want to do MBSE in our Company and downloaded Virtual Satellite but we don't understand how it works...”*

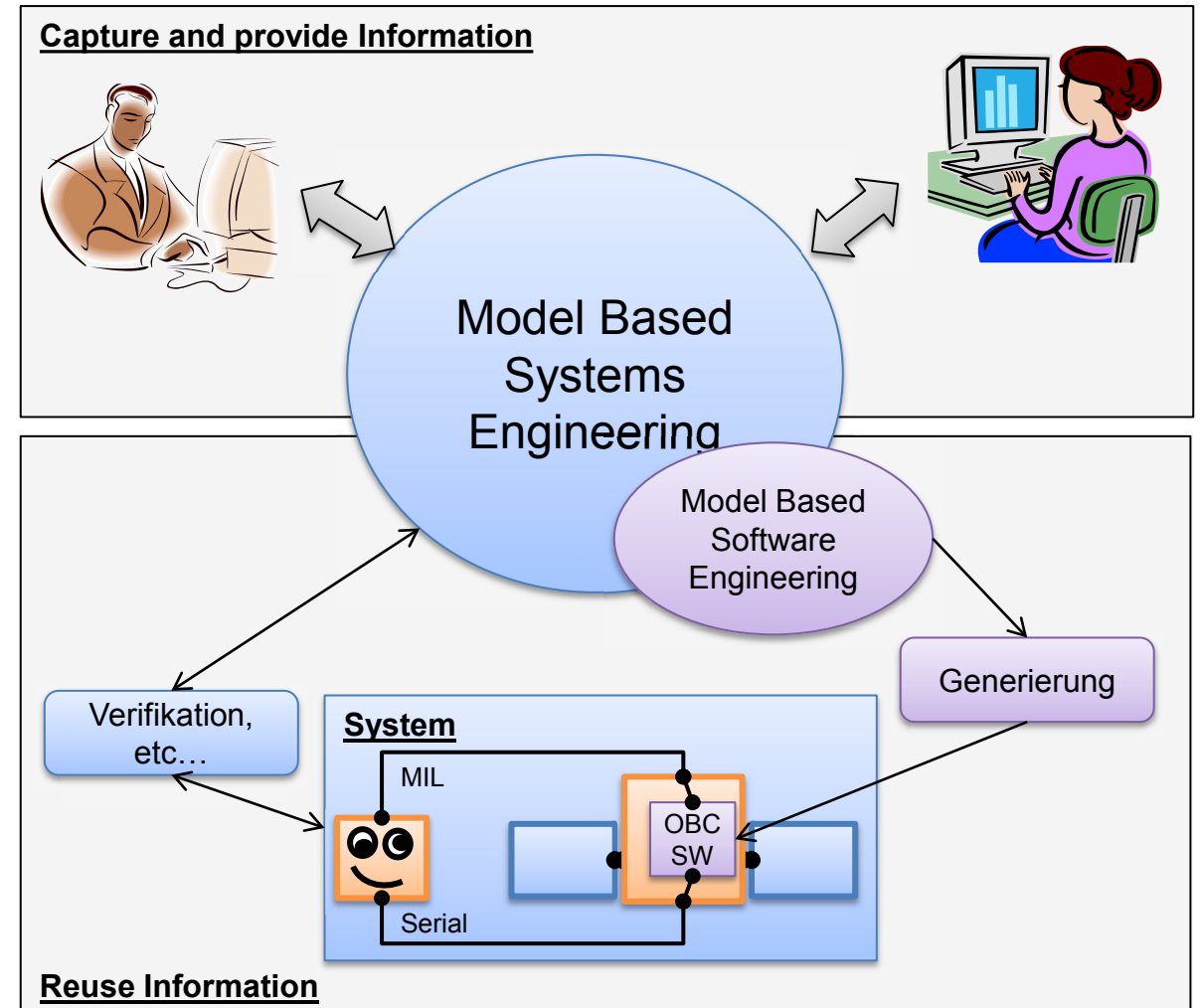
- There is not one answer of MBSE to your questions
- And don't start modelling for the sake of modelling!
  - Ask yourself what you want to do with it?
  - What is your envisaged return of investment?



# Alright, so What is Model Based Systems Engineering

## MBSE in our Context is Some of the Following...

- For us there is no clear cut definition of MBSE:
  - Model Based Systems Engineering
  - Model Based Software Engineering
  - But also Process/Workflow Automation
- Anyway all of them target to ...
  - ... collect information
  - ... improve consistency of information
  - ... centralize information
  - ... control information flow
- *Altogether, the extra task of modelling should deliver a benefit in time, efficiency, money, etc. to you!*







**Early Spacecraft Design has an Intense Information Exchange  
MBSE Helps to Organize, Structure and Analyze the Information**

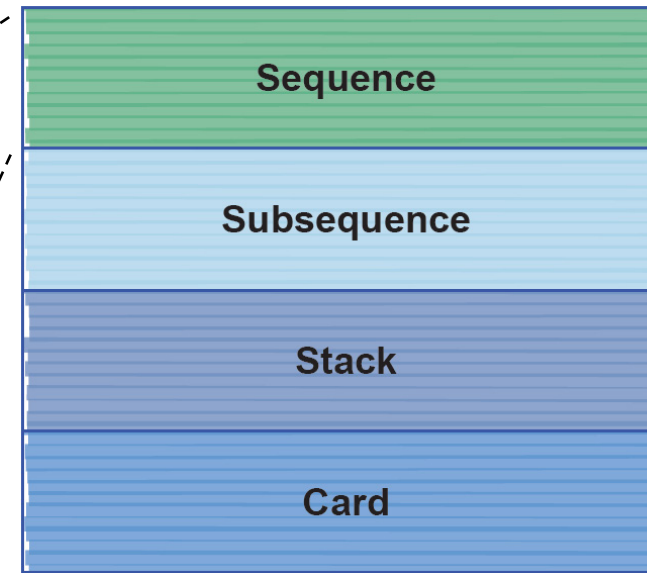
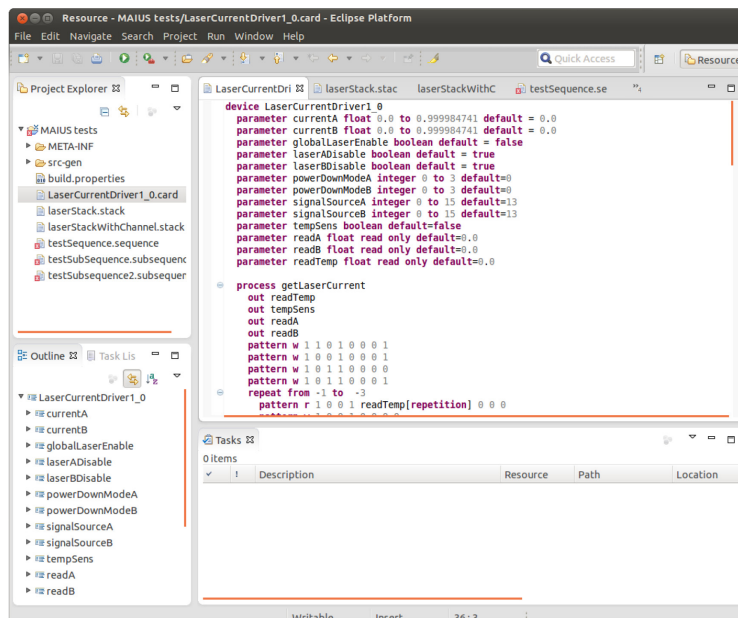
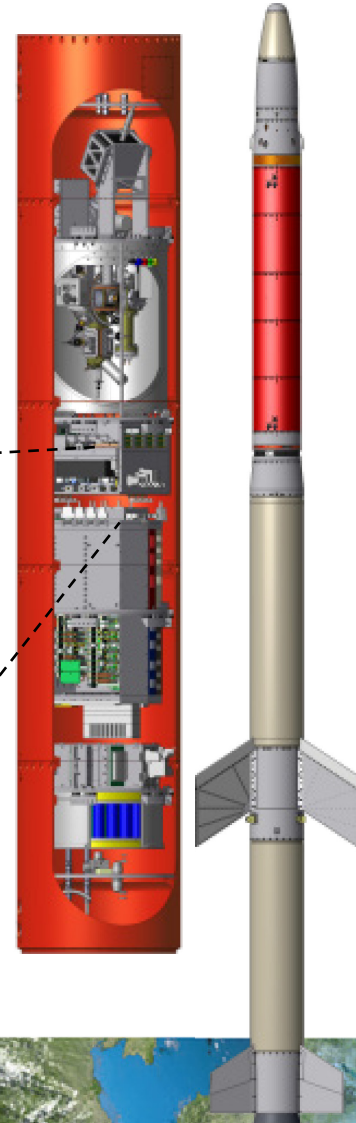


# A Model for Understanding Each Other

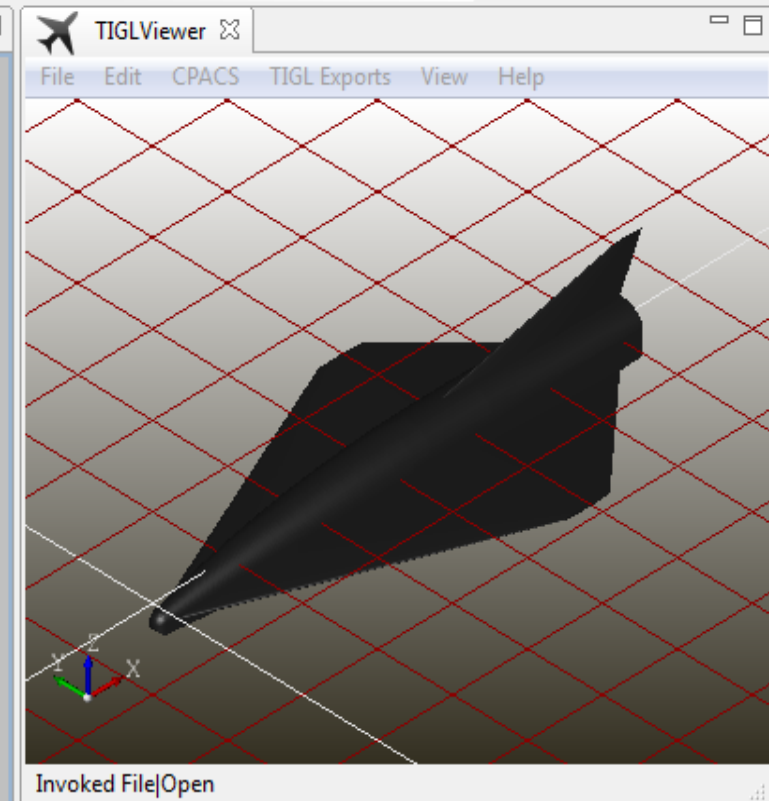
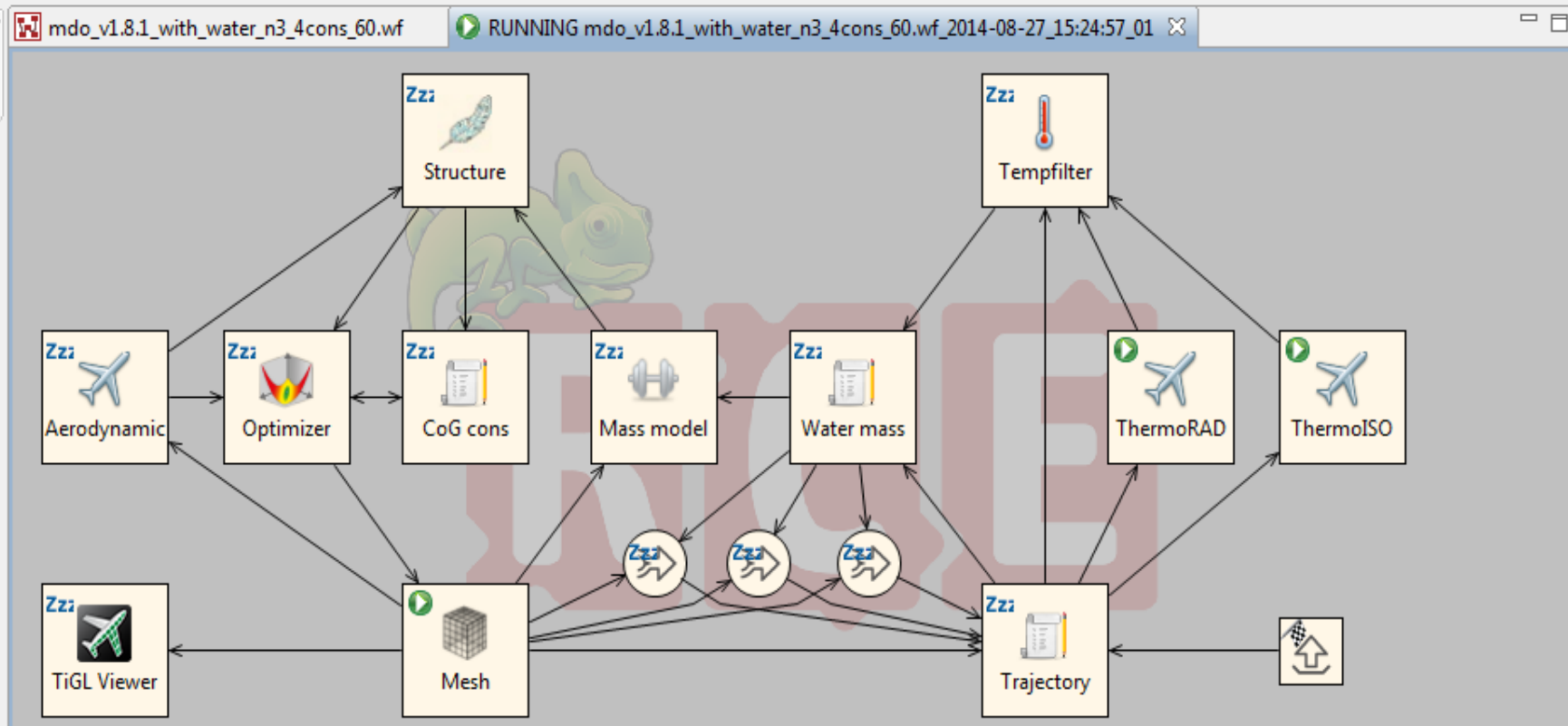
## MBSE for the Purpose of Code Generation



- Scientists don't understand the engineers and the engineers don't understand the scientists.
- Introducing MBSE with a textual model as a formal language to describe the execution of the scientific experiment.
- The engineers' code generator uses the model to generate on board software from the model.







Workflow Data Browser Log Properties Workflow List Workflow Console

- mdo\_v1.8.1\_with\_water\_n3\_4cons\_60.wf\_2014-08-27\_15:24:57\_01 (2014-08-27 15:25:13) <local>
  - Timeline
  - Timeline by Component
    - Mass model
    - Mesh
      - Run 3 (2014-08-27 15:27:18)
        - Inputs
        - Outputs
          - 1.1 CoAx\_body: '34.0127'

Network

- RCE Client 1 <Self>
- RCE Relay Server
- RCE Server 1 <Workflow Host>
  - Published Components
    - GGHv3 (1.05)
    - Hysap1\_nobatch (1.0)
- RCE Server 2 <Workflow Host>
  - Published Components
    - STSMV10 (1.0)
    - Tempfilter (1.0)



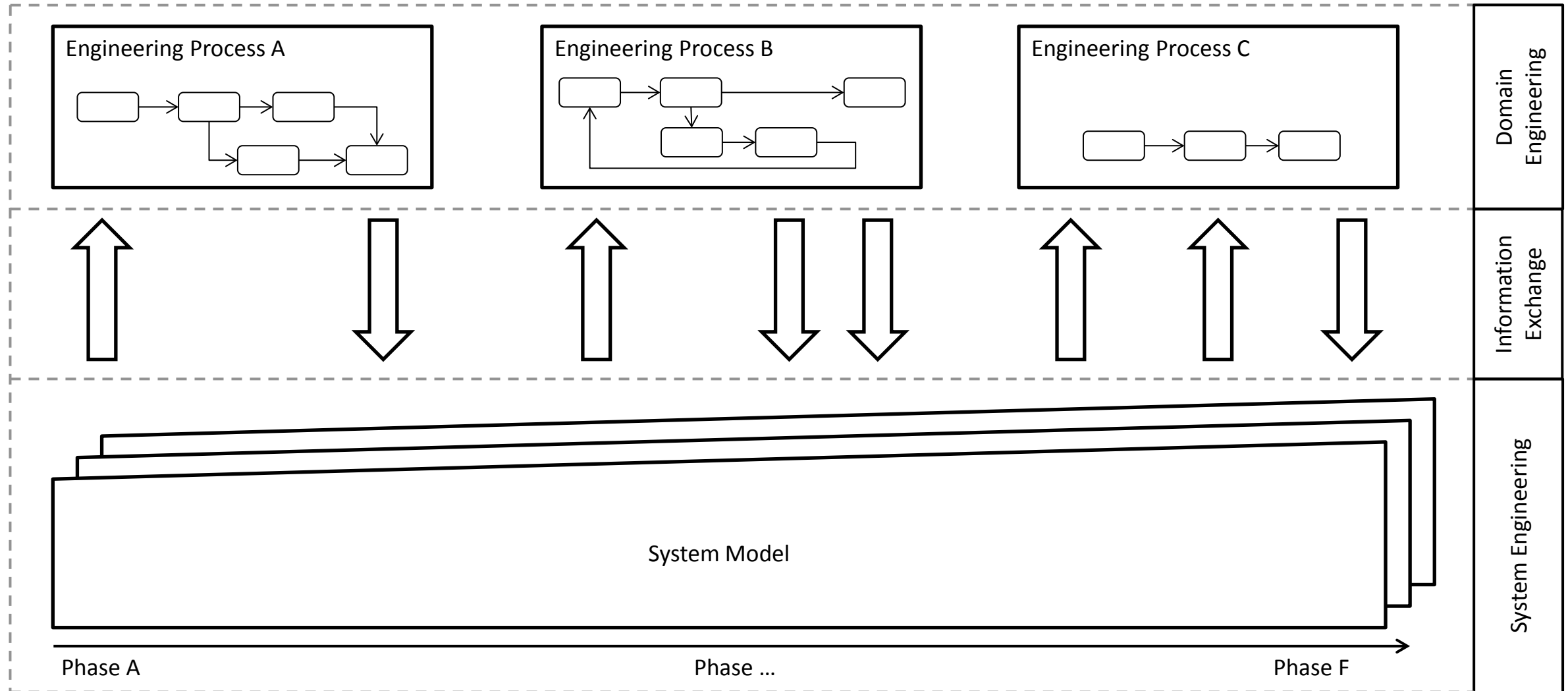
# MBSE for Improving the Simulation and Design Process of Aircraft

## Workflow Automation with one Parametric Data Model in the Back



# MBSE Aims for Data Continuity Through the whole Life of a Spacecraft

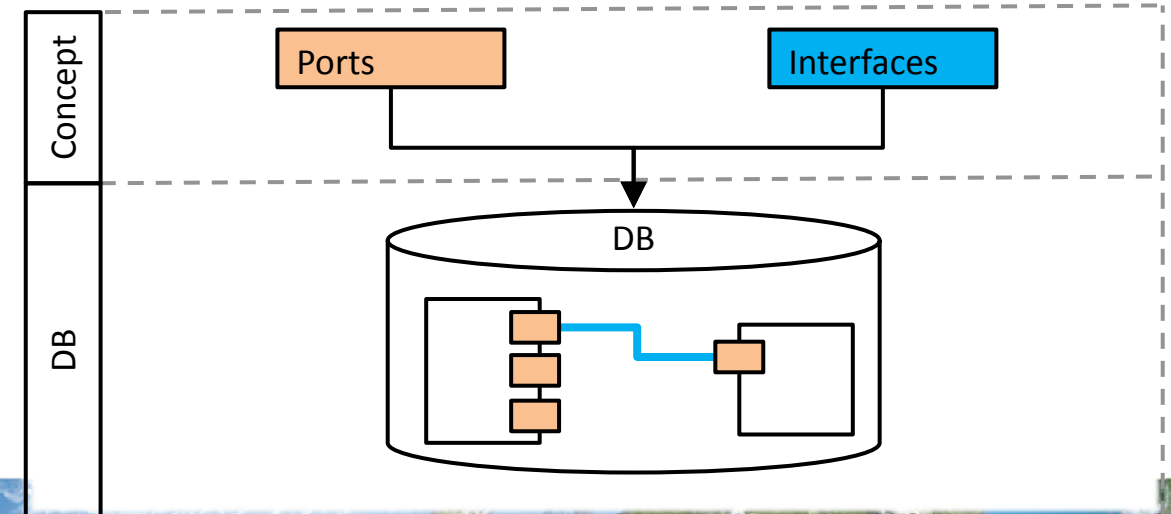
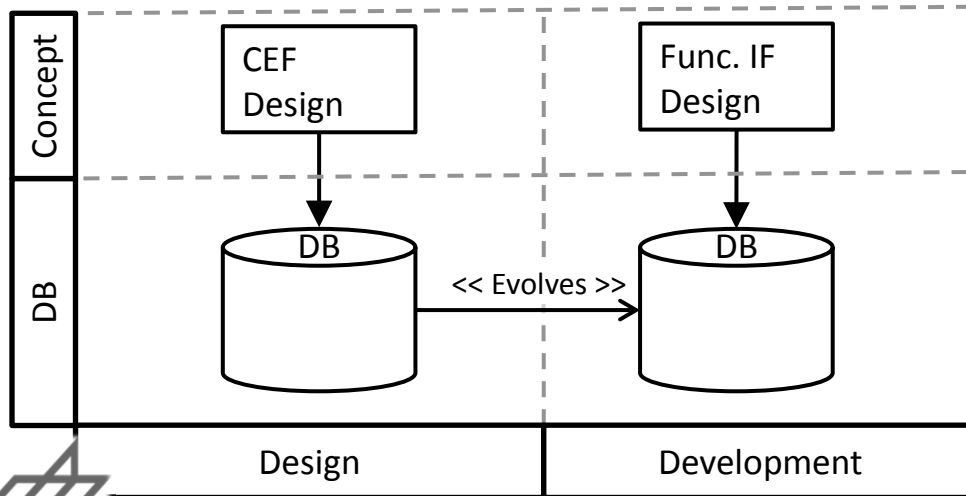
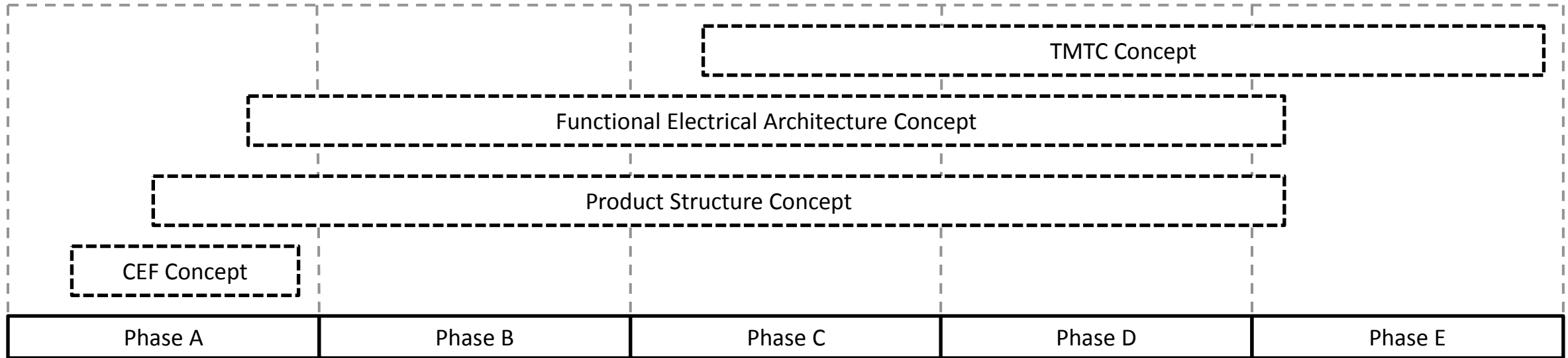
## Identifying Todays and Tomorrows Information to be Exchanged





# Extending the Model When The Requirements of Tomorrow are Known

## Our Latest Research to Extend our Data Base Models by Concepts

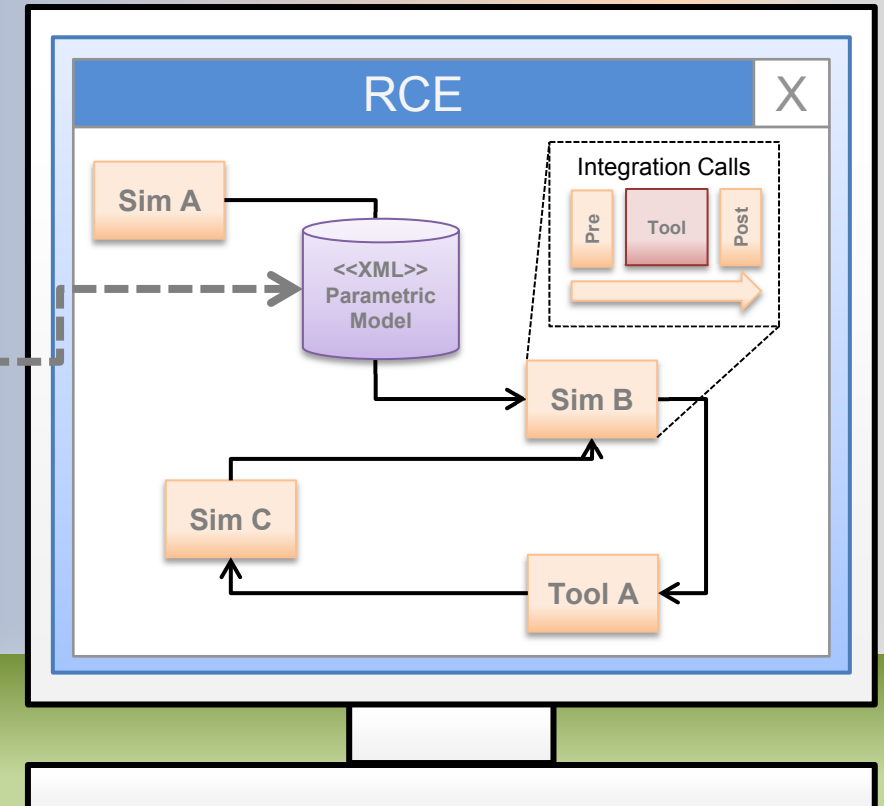
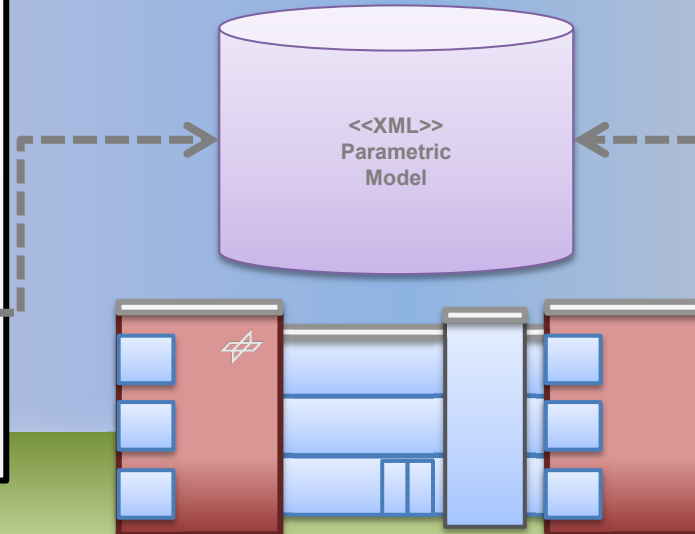
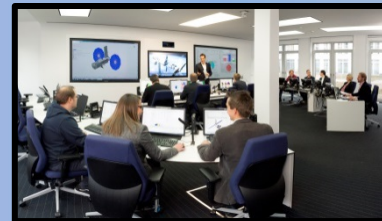
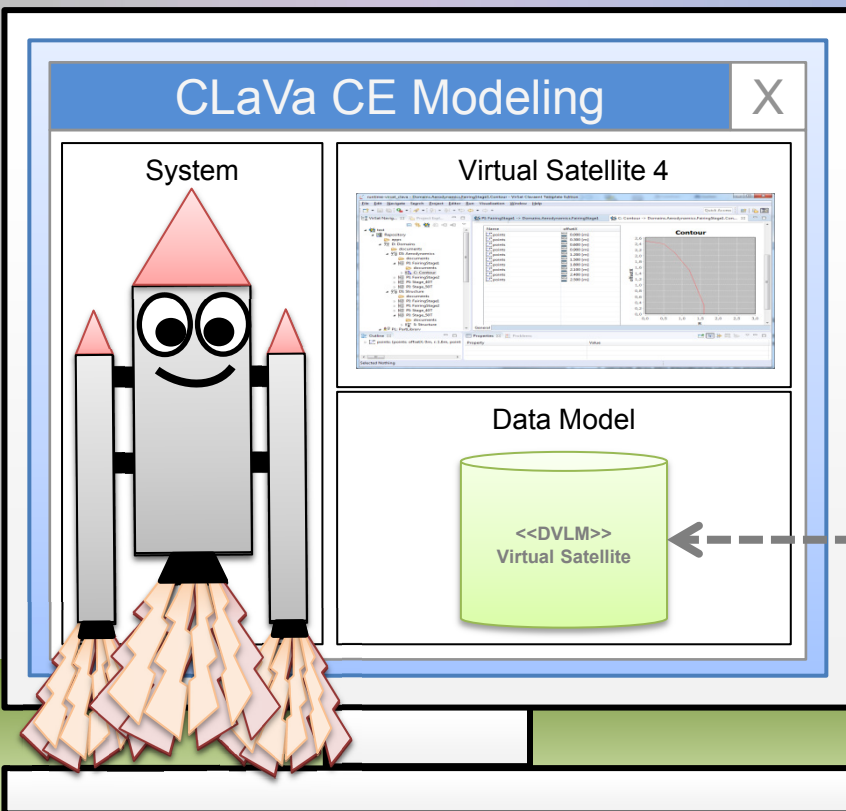
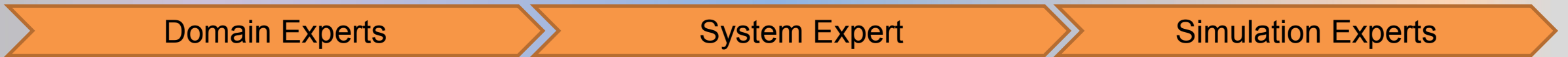




# Successful MBSE for Satellites but What About Launchers?

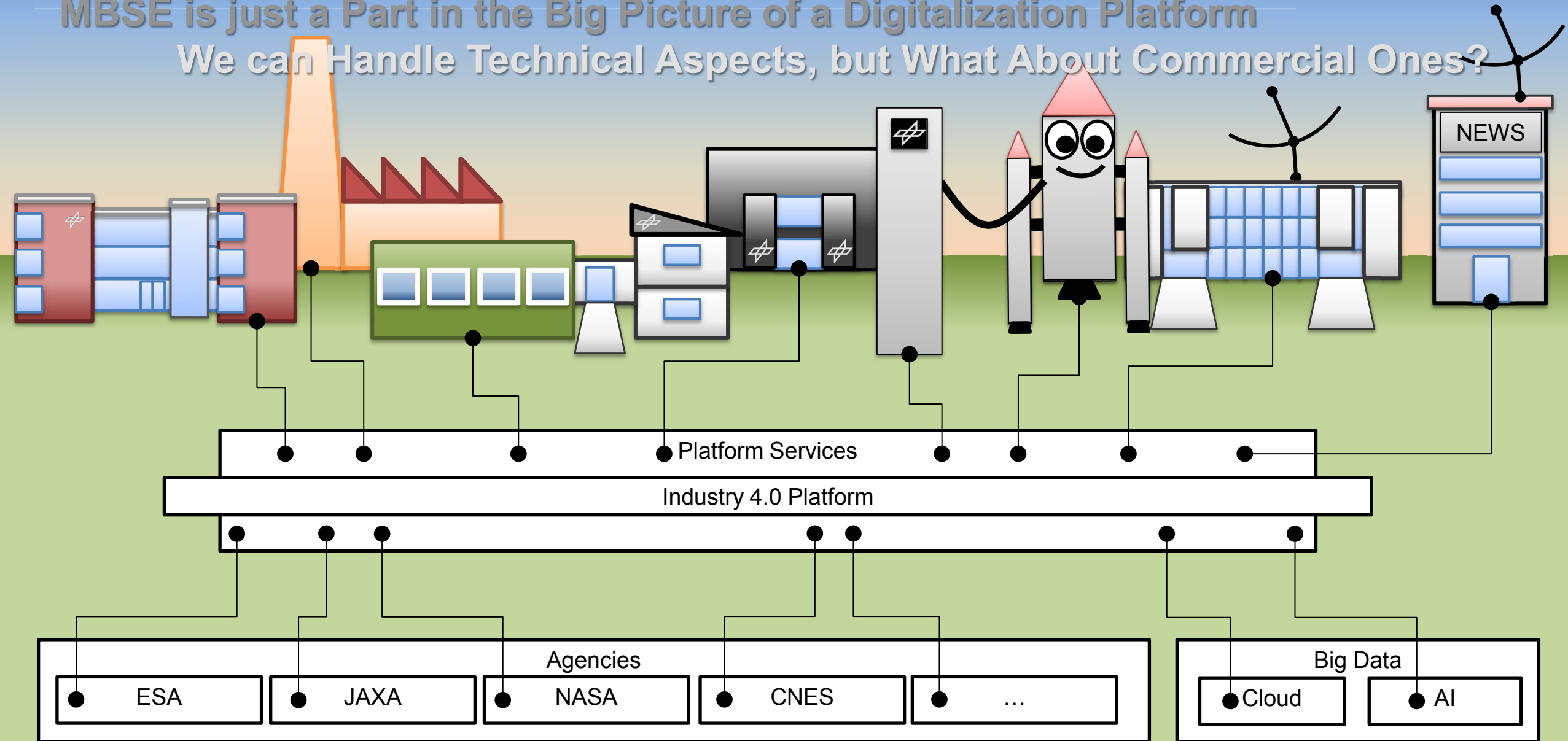
## We Have the Tools but we don't yet Fully Understand the Process!

Day 2



# MBSE is just a Part in the Big Picture of a Digitalization Platform

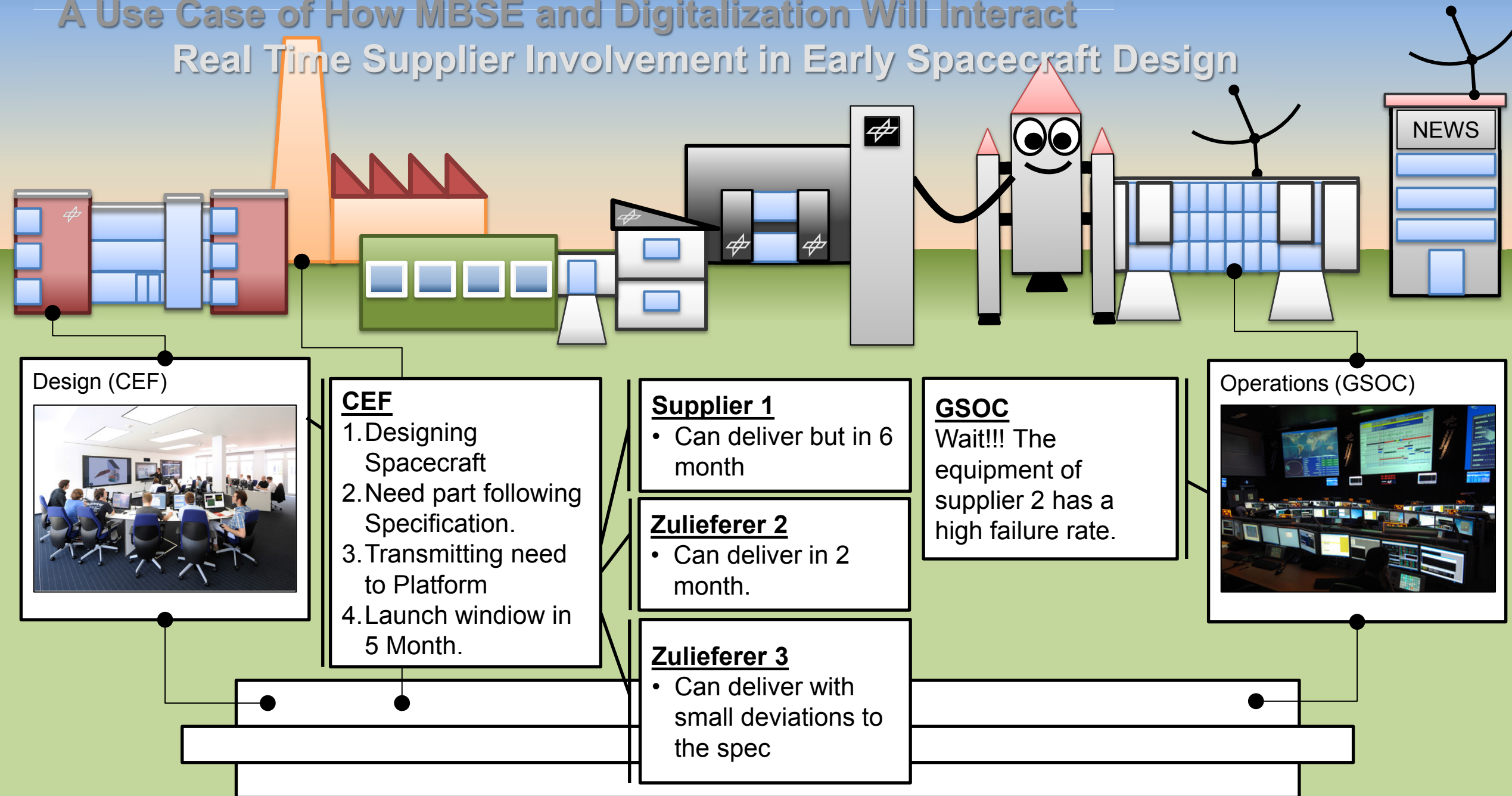
## We can Handle Technical Aspects, but What About Commercial Ones?





# A Use Case of How MBSE and Digitalization Will Interact

## Real Time Supplier Involvement in Early Spacecraft Design





**Researching the Emerging Trends in Digitalization  
Integrating Mixed Reality and Cyber Physical Systems**



## Back to the Question of What is MBSE?

### It Remains a Question of What You Make Out of it!

- There is nothing such as the one MBSE that solves all your problems.
- Be precise when talking about MBSE !!!
- Even though you have some MBSE already running. Applying it to a new field can be tricky.
- MBSE is already a huge topic, but we have to see how it fits into the bigger picture of digitalization.
- *If you have questions, give me a call: „Hi Phil! We want to improve MBSE in our Company and Virtual Satellite doesn't help, but we have an idea of adjusting it...” ;-)*



## End of Presentation

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